Demo material testing data for FEMCard Basic 1.3

The following folders contain sample files for material property identification with *FEMCard Basic*.

To give the fullest possible overview of the optimization processes in *FEMCard Basic*, synthetic measurement data is used in the examples. This data has been created with the same material models that are used later in *FEMCard Basic* for "re-" identification.

For each considered material a *.pip-file, *.txt-files and *.jpg-files are available. The *.pip-files are project files from FEMCard Basic and can be opened by clicking "File" -> "Open". You can then perform a material data identification with experimental data.

If you want to create your own project, you can put together the experimental data from the associated *.txt-files to learn more about the identification process. The *.jpg-files show the respective synthetic measurement curves.

IN THE TRIAL VERSION OF *FEMCard Basic* NO MATERIAL CHARACTERISTICS ARE DISPLAYED, but only the quality of fit between the simulated and measured curves.

The monitored and resulting material properties are available in the full version.

The reports for each test project created with the full version (PIP-project-name.pdf and PIP-project-name.txt) are enclosed.

Notes to the sample files for isotropic material models:

The following examples of isotropic materials are stored under "A_isotropic_material\":

1.) The first example in "A_scattered_elastoplastic\" indicates an identification for von Mises plasticity with (strongly) scattering measurements.

2.) In the example "B_viscoplastic_creep_relaxation\" the material parameter identification for von Mises Viscoplasticity using a creep and/or a relaxation test is shown.

3.) Under "C_hyperelastic\" the material parameters for the (synthetic) measurement data of a foam are optimized. To determine the compressibility of the material, the transverse strains of the shown tensile test are taken into account.

4.) "D_viscoelasticity_small_strain\" shows two examples of the identification for a viscoelastic material at small strains. The first example is emanating from an incompressible material, thus no lateral strains must be measured and read from the tensile test. In the example for the compressible material, the transverse strain is used for identification in contrary.

5.) In the example "E_viscoelasticity_large_strain\", three uniaxial tensile tests are used to fit the parameters for Ogden-viscohyperelasticity with 4 relaxation modules. Since the material is compressible, transverse strains are also taken into account for the tensile tests. Note: Often it is useful to apply true stress and strain measurement data for the identification for Ogden-viscohyperelasticity: When using nominal stress and strain measurement data the parameter iteration might stop due to lack of convergence of the (stress-controlled) material model.

Notes to the sample files for transversely isotropic material models:

The following examples are stored under "B_transversely_isotropic\":

1.) In "A_quasi_static\large_strain\" the material parameters of a sheet metal material for Hill-plasticity are optimized. It is assumed that the material has transversely isotropic properties. Remark: In this example the elastic constants are known (for example, by means of a preliminary identification) and are kept fixed during the identification.

2.) In "A_quasi_static\small_strain" a similar example for small strains is considered.

3.) The example in "B_crash\" shows the parameter identification for a composite material under crash loading. The first strain rate under uniaxial load is at approximately 200% technical elongation per second. The second strain rate is at about 20% technical elongation per second. For these experiments only the axial strains have been read. The other tests were performed at quasi-static loading rates (for example about 0.2% technical strain per second in the tensile test).

FEMCard Basic

Notes to the format of text files for importing data

The columns with the measurement data can be separated by spaces / tabs, commas or semicolons.
The numbers in the columns are floating point numbers with a point as a separator (decimal point).
Examples are 60.2 or 6.0200E+001 or 6.0200E001 or 6.0200e+001 or 6.0200e001 etc.

! All lines in the text files

- that do not meet the above conditions, like e.g.
  - comment lines (such as Header with experimental or column names)
  - generally: rows with non-numeric data
- with measured values that should not be imported
- which lead to unequal number of columns

must begin with a **# ("Number sign")**.